



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/680,229	10/08/2003	Kui Yao	4249-0112P	5826
2292 7590 10/31/2007 BIRCH STEWART KOLASCH & BIRCH PO BOX 747 FALLS CHURCH, VA 22040-0747			EXAMINER TALBOT, BRIAN K	
			ART UNIT 1792	PAPER NUMBER
			NOTIFICATION DATE 10/31/2007	DELIVERY MODE ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mailroom@bskb.com

## Office Action Summary

Application No.

10/680,229

Applicant(s)

YAO ET AL.

Examiner

Brian K. Talbot

Art Unit

1792

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 08 August 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-17, 19, 21, 22 and 24-34 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-17, 19, 21, 22 and 24-34 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- ☐ Notice of Informal Patent Application
- ☐ Other: \_\_\_\_\_

Art Unit: 1792

1. The amendment filed 8/8/07 has been considered and entered. Claims 18,20,23 and 35-38 have been canceled. Claims 1-17,19,21,22 and 24-34 remain in the application.
2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
3. In light of the amendment filed 8/8/07, the 35 USC 112 second paragraph rejection has been withdrawn.
4. In light of the arguments filed 8/8/07, the rejections concerning the reference Sandhage (5,318,725) have been withdrawn.

***Claim Rejections - 35 USC § 103***

1. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-4,11-14,16,17,19,21,24-26,28-31,33 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over GB 2161647 in combination with Buchanan et al. (4,283,228) further in combination with Fernandez et al. "Processing and microstructure of porous and dense PZT thick films on  $\text{Al}_2\text{O}_3$ ".

GB 2161647 teaches a piezoelectric device whereby a piezoelectric layer is formed from a composition including piezoelectric powder and a glass-like binding agent. The piezoelectric material is PZT while the binding agent is lead borosilicate. A liquid carrier is utilized to form a paste for screen printing the piezoelectric material to form a film (abstract). After screen printing, the piezoelectric layer is fired by heating to form the layer. The thickness can be from 10-100 microns. The grain size of the powder is 5-10 microns or less. The liquid carrier is ethyl cellulose and terpineol. Electrodes can be applied by a printing process to the PZT film and include silver (pg. 1, line 95 – pg. 4, line 20).

GB 2161647 fails to teach the liquid phase precursor of metal oxide for the binding agent.

Buchanan et al. (4,283,228) teaches low temperature densification of PZT ceramics. The addition of 1-6 weight percent of  $\text{V}_2\text{O}_5$  promotes rapid densification and therefore lower temperatures of sintering PZT (abstract). The  $\text{V}_2\text{O}_5$  can be added as a salt or added with an alcohol and a dispersant (col. 2, lines 5-15 and col. 4, lines 25-35). The  $\text{V}_2\text{O}_5$  can be used as a sintering aid.

Therefore it would have been obvious for one skilled in the art at the time the invention was made to have modified GB 2161647 PZT process by incorporating the "binding agent" in liquid form as evidenced by Buchanan et al. (4,283,228) with the expectation of achieving similar success.

GB 2161647 in combination with Buchanan et al. (4,283,228) fail to teach milling the PZT powder and carrier to form a paste.

Fernandez et al. "Processing and microstructure of porous and dense PZT thick films on  $\text{Al}_2\text{O}_3$ " teaches PZT films by taking ceramic powders and organic carrier (terpeinol and ethyl cellulose) and milling to form a paste to be screen printed (pg. 5400, col. 2).

Therefore it would have been obvious for one skilled in the art at the time the invention was made to have modified GB 2161647 in combination with Buchanan et al. (4,283,228) PZT process by incorporating a milling step to form the paste as evidenced by Fernandez et al. "Processing and microstructure of porous and dense PZT thick films on  $\text{Al}_2\text{O}_3$ " with the expectation of achieving similar success.

Claims 5-10 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over GB 2161647 in combination with Buchanan et al. (4,283,228) further in combination with Fernandez et al. "Processing and microstructure of porous and dense PZT thick films on  $\text{Al}_2\text{O}_3$ " further in combination with either Akiyama et al., "Development of lead zirconate titanate family thick films on various substrates" or Thiele et al. "Processing and properties of screen-printed lead zirconate titanate piezoelectric thick films on electroded silicon".

GB 2161647 in combination with Buchanan et al. (4,283,228) further in combination with Fernandez et al. "Processing and microstructure of porous and dense PZT thick films on  $\text{Al}_2\text{O}_3$ " fails to teach the "binding agent", i.e. sintering aids being  $\text{LiO}_2$  and  $\text{B}_2\text{O}_3$  and combination thereof.

Akiyama et al., "Development of lead zirconate titanate family thick films on various substrates" or Thiele et al. "Processing and properties of screen-printed lead zirconate titanate piezoelectric thick films on electroded silicon" both teach using sintering aids for PZT formation including  $\text{LiO}_2$  and  $\text{B}_2\text{O}_3$  and combination thereof (abstract and pg. 5524/ pg. 2863) respectively.

Therefore it would have been obvious at the time the invention was made to have modified GB 2161647 in combination with Buchanan et al. (4,283,228) further in combination with Fernandez et al. "Processing and microstructure of porous and dense PZT thick films on  $\text{Al}_2\text{O}_3$ " process by utilizing sintering aids for PZT formation including  $\text{LiO}_2$  and  $\text{B}_2\text{O}_3$  and combination thereof as evidenced by Akiyama et al., "Development of lead zirconate titanate family thick films on various substrates" or Thiele et al. "Processing and properties of screen-printed lead zirconate titanate piezoelectric thick films on electroded silicon" with the expectation of achieving similar success.

Regarding claims 7-10 and 15, the claims recite particular compounds for the "binding agent", i.e. sintering aids being  $\text{LiO}_2$  and  $\text{B}_2\text{O}_3$  and combination thereof. While the Examiner acknowledges the fact that the references relied upon fails to specifically recite the claimed compounds, it is the Examiner's position that one skilled in the art at the time the invention was made would have had a reasonable expectation of achieving similar success regardless of the particular compounds utilized to include  $\text{LiO}_2$  and  $\text{B}_2\text{O}_3$ . If Applicant disagrees, Applicant is invited to supply a showing of unexpected results regarding the material compound utilized to introduce  $\text{LiO}_2$  and  $\text{B}_2\text{O}_3$  versus those utilized by the prior art. Applicant is reminded upon such a showing that all claims be amended to include such a limitation so as to be commensurate in scope with the showing.

Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over GB 2161647 in combination with Buchanan et al. (4,283,228) further in combination with Fernandez et al. "Processing and microstructure of porous and dense PZT thick films on  $\text{Al}_2\text{O}_3$ " further in combination with Maas et al. "Thick-film printing of PZT onto silicon".

GB 2161647 in combination with Buchanan et al. (4,283,228) further in combination with Fernandez et al. "Processing and microstructure of porous and dense PZT thick films on  $\text{Al}_2\text{O}_3$ " fails to teach the claimed organic carrier ESL 400.

Maas et al. "Thick-film printing of PZT onto silicon" teaches incorporating an organic binder vehicle of ESL 400 to a powdered PZT to form a PZT paste for thick-film printing (pg. 109).

Therefore it would have been obvious for one skilled in the art at the time the invention was made to have modified GB 2161647 in combination with Buchanan et al. (4,283,228) further in combination with Fernandez et al. "Processing and microstructure of porous and dense PZT thick films on  $\text{Al}_2\text{O}_3$ " by incorporating a organic vehicle of ESL 400 as evidenced by Maas et al. "Thick-film printing of PZT onto silicon" with the expectation of achieving similar success.

Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over GB 2161647 in combination with Buchanan et al. (4,283,228) further in combination with Fernandez et al. "Processing and microstructure of porous and dense PZT thick films on  $\text{Al}_2\text{O}_3$ " further in combination with Yao et al. "Improved preparation procedure and properties for a multilayer piezoelectric thick-film actuator".

GB 2161647 in combination with Buchanan et al. (4,283,228) further in combination with Fernandez et al. "Processing and microstructure of porous and dense PZT thick films on  $\text{Al}_2\text{O}_3$ " fails to teach the claimed isostatic pressing step.

Yao et al. "Improved preparation procedure and properties for a multilayer piezoelectric thick-film actuator" teaches incorporating a high isostatic pressure step on a green PZT film before firing and bonding to an electrode (abstract).

Therefore it would have been obvious for one skilled in the art at the time the invention was made to have modified GB 2161647 in combination with Buchanan et al. (4,283,228) further in combination with Fernandez et al. "Processing and microstructure of porous and dense PZT thick films on  $\text{Al}_2\text{O}_3$ " process by incorporating a high isostatic pressing step as evidenced by Yao et al. "Improved preparation procedure and properties for a multilayer piezoelectric thick-film actuator" because of the improved material density and bonding strength resulting from the pressing step.

Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over GB 2161647 in combination with Buchanan et al. (4,283,228) further in combination with Fernandez et al. "Processing and microstructure of porous and dense PZT thick films on  $\text{Al}_2\text{O}_3$ " further in combination with Chen et al. "Dielectric, ferroelectric and piezoelectric properties of lead zirconate titanate thick films on silicon substrates".

GB 2161647 in combination with Buchanan et al. (4,283,228) further in combination with Fernandez et al. "Processing and microstructure of porous and dense PZT thick films on  $\text{Al}_2\text{O}_3$ " fails to teach the claimed platinum substrate.



Chen et al. "Dielectric, ferroelectric and piezoelectric properties of lead zirconate titanate thick films on silicon substrates" teaches forming PZT films on platinum buffered silicon substrates (abstract).

Therefore it would have been obvious for one skilled in the art at the time the invention was made to have modified over GB 2161647 in combination with Buchanan et al. (4,283,228) further in combination with Fernandez et al. "Processing and microstructure of porous and dense PZT thick films on  $\text{Al}_2\text{O}_3$ " by utilizing a platinum buffered substrate as evidenced by Chen et al. "Dielectric, ferroelectric and piezoelectric properties of lead zirconate titanate thick films on silicon substrates" with the expectation of achieving similar success.

### ***Response to Amendment***

Applicant's arguments filed 8/8/07 have been fully considered but they are not persuasive.

Applicant argued that the prior art failed to teach the sintering agent being in a liquid phase metal oxide.

Buchanan et al. (4,283,228) teaches this limitation as noted above. Buchanan et al. (4,283,228) teaches using the metal oxide with the aid of a dispersant of alcohol. This would meet the limitation of a liquid metal oxide as the claimed liquid metal oxide can utilize an alcohol (see claim 7).

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian K. Talbot whose telephone number is (571) 272-1428. The examiner can normally be reached on Monday-Friday 8AM-4PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy H. Meeks can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1792

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

 10/17/07

Brian K Talbot  
Primary Examiner  
Art Unit 1762

BKT